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FLOOD INSURANCE STUDY

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TOWN OF HOLDERNESS, NEW HAMPSHIRE

GRAFTON COUNTY

OCTOBER 15, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 330059

FEMA 209

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

TOWN OF HOLDERNESS, GRAFTON COUNTY, NEW HAMPSHIRE

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Holderness, Grafton County, New Hampshire, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Town of Holderness to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Department of Agriculture, Soil Conservation Service, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-8-77, Project Order No. 15. This study was completed in August 1978.

1.3 Coordination

A meeting was held in the Town of Holderness on August 23, 1976, attended by officials of the Town of Holderness, a representative of the FIA, and representatives of the Soil Conservation Service (SCS). The meeting was held to explain the nature and purpose of the study, the scope and limits of the work, as well as to determine the streams requiring detailed study.

On May 9, 1979, the results of the Flood Insurance Study were reviewed and accepted at a final meeting attended by personnel of the SCS, the FIA, and representatives of the Town of Holderness.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Holderness. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through August 1983.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and the Town of Holderness.

The flooding sources studied in detailed methods are listed below:

a. the Pemigewasset River, from the southern corporate limit to the northern corporate limit;

b. Owl Brook, from just downstream of State Route 175 to about 500 feet upstream of Perch Pond Road; and

c. Beede Brook, from the confluence of Owl Brook to 400 feet upstream of Perch Pond Road.

Flooding associated with Squam Lake, Little Squam Lake, and White Oak Pond were studied by approximate methods.

2.2 Community Description

The Town of Holderness is located in central New Hampshire in the southeastern portion of Grafton County. The Town of Plymouth is the adjoining town to the west across the Pemigewasset River and is the largest nearby commercial and market center. Other nearby towns are Ashland to the south, Campton to the north, and Center Harbor to the east. The 1970 census population of 1,048 for Holderness shows a 40 percent increase over the 1960 census population which places the town sixteenth largest out of 40 towns and cities in Grafton County (Reference 1). The Town of Holderness is located on U.S. Route 3 and directly between Squam Lake and Little Squam Lake. Two other locations of year-round activity exist in the town. One is known as Hardhack Corner where the Holderness Central Elementary School and a construction firm are located. The other area is Holderness School, a preparatory school, located on a high plateau overlooking the wide Pemigewasset River flood plain directly east from the Town of Plymouth.

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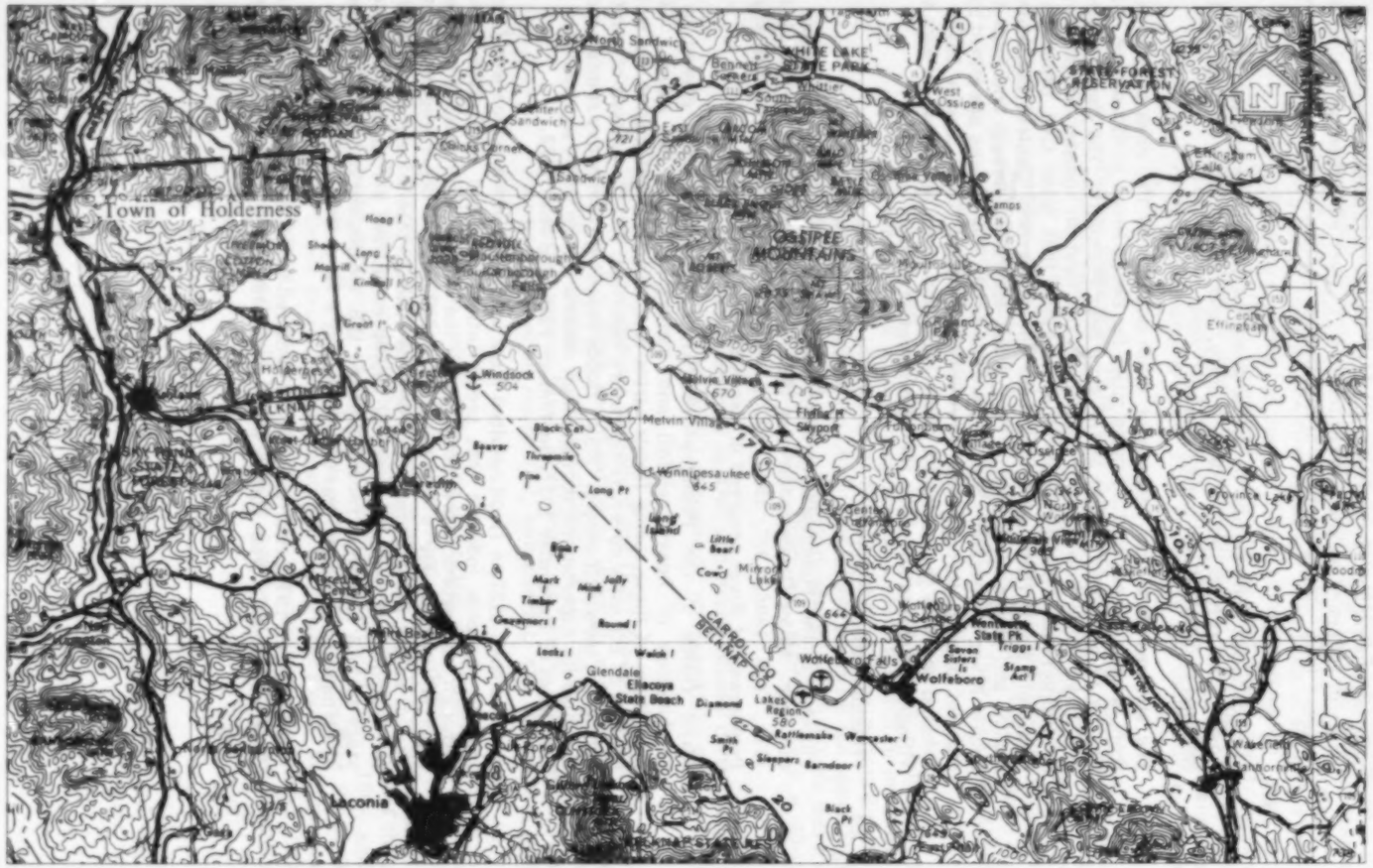

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

TOWN OF HOLDERNESS, NH

(GRAFTON CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The average annual rainfall for Holderness is 44 inches, but in the more mountainous region of the headwaters of the Pemigewasset River, up to 60 inches of rain can be expected (Reference 2). Over 90 percent of Holderness is forest land. Major portions of Holderness contain pervious, well-drained soils.

The activities contributing to the economy of Holderness are the export of timber, the private educational facility, and the services supplied to the seasonal residential and tourist market.

The streams that flow through or drain portions of the town vary in size from drainage areas of 2.2 square miles for Beede Brook to 622 square miles for the Pemigewasset River at the gage near Plymouth. The Pemigewasset is a major south flowing river that forms the western boundary of the Town of Holderness. Beede Brook is a tributary that joins Owl Brook on a relatively small flood plain area near the Holderness Central Elementary School and Hardhack Corner. Owl Brook leaves Holderness and joins the Squam River in Ashland. Squam Lake and Little Squam Lake are joined by a channel passing through the Town of Holderness. The Squam River in Ashland provides the outlet for these lakes and flows southwest through the Village of Ashland and on to the Pemigewasset River.

2.3 Principal Flood Problems

Flooding in the Pemigewasset River basin may occur during all seasons of the year. Major floods occurred in 1785, 1824, 1826, 1830, 1839, 1852, 1869, 1878, 1895, 1896, 1927, 1936, 1938, and 1973. The flood of record on the Pemigewasset River occurred in March 1936.

Major floods in the Pemigewasset River basin are often caused by a combination of heavy rainfall and melting snow in the spring. The magnitude of these spring floods varies considerably depending on the water content of the snow cover, temperature variation, and the amount of rainfall during the snowmelt period. Major floods resulting from heavy rainfall alone can also be experienced during other seasons of the year, as evidenced by the floods of November 1927, September 1938, and June 1973.

In November 1927, a flood resulted from a tropical storm which was forced inland. Records indicate that precipitation increased with altitude, and although no records were obtained in the White Mountains, it has been reported that nearly 9 inches of rain fell in the upper regions of the Pemigewasset River watershed. Records indicate that 5.3 inches of rain fell in Plymouth. A peak discharge of 60,000 cubic feet per second (cfs) and a stage of 27.4 feet were recorded at the U.S. Geological Survey (USGS) gage in Plymouth. This flood was approximately a 90-year flood (Reference 3).

During March 1936, two flood events occurred which resulted in the greatest flood of record. The floods were associated with two periods of heavy

rainfall on March 11 to March 12 and March 17 to March 18. The second produced more serious flooding. However, flooding was not due to rainfall alone but rather a combination of factors which are normally associated with spring runoff. The first flood left conditions of saturated ground, warm temperatures, melting snows, filled storage areas, and high river flows. These conditions, combined with the second flood event, produced flood conditions for 10 days with a peak discharge of 65,400 cfs and a stage of 29 feet at the gage in Plymouth on March 19. Ice jams caused additional damage in many areas. This flood was approximately a 130-year flood (Reference 4).

During September 1938, just 2.5 years after the record flood of 1936, the Pemigewasset River basin experienced extensive flooding. From September 17 to September 21, a period of heavy rainfall occurred, associated with the passage of a tropical hurricane. Total precipitation averaged 11.5 inches over New England. A peak discharge of 50,900 cfs and a stage of 23.6 feet were recorded at the gage in Plymouth. This flood was approximately a 40-year flood (Reference 5).

During the last four days of June 1973, a strong moist tropical airflow in association with a stationary frontal system resulted in moderate to heavy shower activity over much of New England. Approximately 8 to 10 inches of rainfall fell in the White Mountains which comprise the upper region of the Pemigewasset River basin. A peak discharge of 47,600 cfs was recorded at the gage in Plymouth. This flood was approximately a 30-year flood (Reference 6).

High water also occurred on Owl and Beede Brooks during all of the above events. As these are small watersheds, no magnitudes of flow or stage were recorded.

The extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. A 10-, 50-, 100-, or 500-year flood on the Pemigewasset River, Owl Brook, or Beede Brook would result in the inundation of some residential, commercial, and agricultural properties in Holderness.

During floods, debris collecting on bridges and culverts could decrease their carrying capacity and cause greater water depths or backwater effect upstream of these structures. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the structures were considered in preparing profiles of the 10-, 50-, 100-, and 500-year floods. All of the six bridges crossing the Pemigewasset River, Owl Brook, and Beede Brook are obstructive to the 10-year flood. In some cases, bridges may be high enough so as not to be inundated by flood flows, however, the road approaches to these bridges may be at lower elevations and subject to flooding.

Water velocities during floods depend largely on the size and shape of the cross sections, conditions of the streams, and the channel bed slope, all of which vary on different streams and at different locations on the same stream. During a 100-year flood, velocities of main channel flow in the study streams would be expected to range from 3 to 12 feet per second. Water flowing at this rate is capable of causing severe erosion to streambanks and fill around bridge abutments, as well as transporting large objects. Velocities of flood plain flow would be expected to range from one to four feet per second. Waters flowing at two feet per second or less would deposit debris and silt.

Depths of water during floods depend largely on the physical characteristics of the stream. These features vary greatly on different streams and at different locations on the same stream. During a 100-year flood, depths along the Pemigewasset River will range between 30 to 40 feet in the main channel and 10 to 20 feet over the flood plain. On Owl and Beede Brooks depths ranging from 5 to 12 feet in the main channel and 1 to 6 feet over the flood plain can be expected.

2.4 Flood Protection Measures

There are seven flood control reservoirs within the Pemigewasset River Basin upstream of Holderness. These dams on tributaries of the Baker River were built as part of the Baker River PL-566 Watershed Protection and Flood Prevention Project (Reference 7). They are located in Dorchester, Warren, and Wentworth, New Hampshire and contain 7,774 acre-feet of flood storage. One additional dam is proposed in Wentworth on the South Branch Baker River with 3,810 acre-feet of flood storage. This study reflects the effects of seven dams already constructed. If the final dam is built in a few years the 100-year flood flow in Holderness will be lowered 1.0 foot and reduced to 59,000 cfs.

Nonstructural methods of flood protection are also being utilized to aid in the prevention of future flood damage. The FIA had identified the special flood hazard area in the town by publishing a Flood Hazard Boundary Map (Reference 8). Holderness was accepted into the emergency phase of the program on July 22, 1975 and has adopted flood plain management measures.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the

recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Discharge-frequency data for the Pemigewasset River were developed by the SCS for the Plymouth, New Hampshire, Flood Hazard Analyses (Reference 9).

Discharge-frequency data for all other streams studied in detail were developed using a synthetic rainfall-runoff procedure that relied on regionalized climatological data coupled with the individual stream physical characteristics for input (Reference 10).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
PEMIGEWASSET RIVER					
At Town line (north)	408	26,000	39,200	45,600	60,600
At Bridge Street	622	35,000	53,500	62,000	82,700
At Town line (south)	625	35,000	53,500	62,000	82,700
BEEDE BROOK					
At School Road	2.2	540	985	1,210	1,850
At Perch Pond Road	1.6	425	770	950	1,450
OWL BROOK					
At State Route 175	6.8	930	1,720	2,150	3,320
At Driveway Bridge	3.4	380	740	940	1,500
At Perch Pond Bridge	1.5	215	420	530	860

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community are carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross section data for streams in the area were obtained from field surveys. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficients (Manning's "n') were estimated by field inspection at each cross section. Observations were made of channel bottom and bank conditions, amount of flow obstruction, and channel meanders and shape variation. Information gathered was analyzed using standard procedures (Reference 11). Roughness values for the main channel of the Pemigewasset River range from 0.030 to 0.055 and on the Owl and Beede Brooks from 0.043 to 0.050; roughness values for all flood plains range from 0.05 to 0.12.

Starting water-surface elevations for the Pemigewasset River were based on an assumption of normal flow at a hydraulic gradient of the 1936 flood (Reference 6). Starting water-surface slope was determined for Owl Brook by engineering judgment based on field measurements of channel bottom and water-surface downstream of the starting cross section. Starting water-surface elevations for Beede Brook were developed from the profiles for Owl Brook. Water-surface elevations of floods of the selected recurrence intervals were computed through use of the SCS WSP-2 step-backwater computer program (Reference 12). Flood profiles were drawn showing computed water-surface elevations for floods of selected recurrence intervals.

Elevations for areas studied by approximate methods were determined by using engineering judgment and existing topographic, soils, and flood boundary publications (References 13, 14, and 8).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:62500, with a contour interval of 20 feet (Reference 13) or maps displaying alluvial soils as mapped by SCS (Reference 14). For the flooding sources studied by approximate methods, the boundary of the 100-year flood was developed from the review of existing topographic, soils, and flood boundary publications (References 13, 14, and 8).

The boundaries of the 100-year and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

Floodways capable of carrying the 100-year flood flow were developed. A two-phase analysis was used on the Pemigewasset River for the Plymouth

Flood Hazard Analyses (Reference 9). Only Phase 1 was used on Owl and Beede Brooks. The first phase, using an SCS computer program, HUD-15, assumes equal conveyance loss encroachments on each side of the flood plain at each cross section to the point that the 100-year stage increased 1.0 foot. This procedure assumes uniform flow conditions. Since these conditions frequently do not occur in natural riverine systems, a second procedure was followed to fine tune the floodways on the Pemigewasset River.

The second phase uses the floodways developed in Phase 1 as a starting point. Encroachment continues until a computer generated water-surface profile (Reference 4) creates induced flood stages of no more than 1.0 foot above the original 100-year levels. This procedure allows floodways to be developed within the limits of floodways developed in Phase 1 and with the knowledge of local land use patterns. Future flood plain developments and modifications will require revised water-surface computations. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). A portion of the floodway of the Pemigewassett River is outside of the corporate limit.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

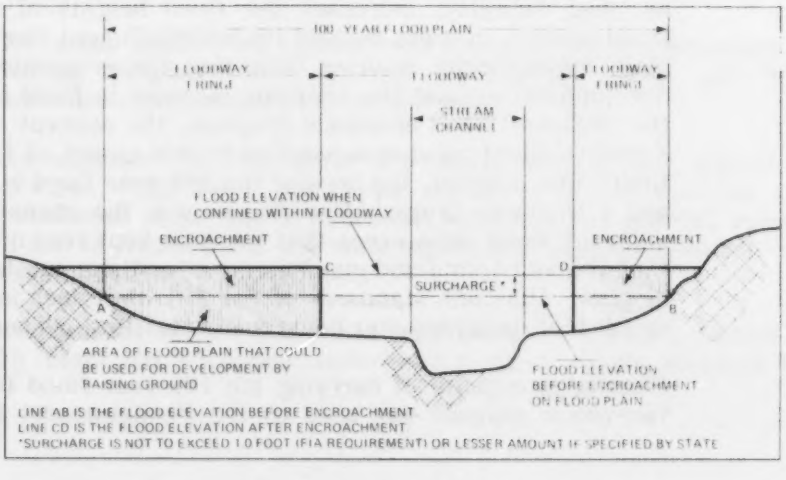
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
PEMIGEWASSET RIVER							
A	290	1494/ 800[3]	36,397	1.7	485.3	484.6	0.7
B	3270	1200[4]	26,944	2.3	485.6	484.7	0.9
C	5510	1449/1300[3]	26,961	2.3	485.8	484.8	1.0
D	6755	915/ 700[3]	17,859	3.5	486.1	485.1	1.0
E	11,235	538/ 300[3]	10,401	4.4	487.4	486.7	0.7
F	13,985	815/ 250[3]	11,764	3.9	488.2	487.5	0.7
G	15,785	480/ 300[3]	6670	6.8	490.8	490.3	0.5
H	16,305	330/ 200[3]	5093	9.0	490.8	490.3	0.5
BEEDE BROOK							
A	620[2]	98	462	2.6	737.6	736.6	1.0
B	750[2]	82	458	2.6	741.1	740.1	1.0
C	1165[2]	77	433	2.2	741.5	740.5	1.0
D	1735[2]	91	318	3.0	743.3	742.3	1.0
E	1810[2]	113	624	1.5	745.5	744.5	1.0
F	2180[2]	102	427	2.2	747.2	746.2	1.0

[1]FEET ABOVE CORPORATE LIMITS
[2]FEET ABOVE CONFLUENCE WITH OWL BROOK
[3]TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS
[4]THIS WIDTH IS BEYOND CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

FLOODWAY DATA

PEMIGEWASSET RIVER - BEEDE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
OWL BROOK							
A	13,300	88	461	4.7	733.9	732.9	1.0
B	13,350	29	4664	0.5	736.5	735.5	1.0
C	13,830	81	549	3.9	736.9	735.9	1.0
D	14,260	88	534	2.2	737.4	736.4	1.0
E	15,220	146	460	2.5	740.0	739.0	1.0
F	16,905	56	231	4.5	751.2	750.2	1.0
G	17,795	46	197	5.2	757.2	756.2	1.0
H	18,825	22	124	7.6	763.4	762.4	1.0
I	18,894	39	278	3.4	765.7	764.7	1.0
J	19,864	65	240	3.9	770.0	769.0	1.0
K	21,099	73	257	3.0	777.3	776.3	1.0
L	22,694	112	270	2.2	783.7	782.7	1.0
M	23,989	20	86	6.2	793.9	792.9	1.0
N	24,496	37	221	2.4	800.1	799.1	1.0

[1]FEET ABOVE CONFLUENCE WITH SQUAM RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

FLOODWAY DATA

OWL BROOK

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the Town of Holderness.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the Town of Holderness are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Town of Holderness was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A2, A3, A5, A16:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Holderness is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

All data presented in this report were developed for the purpose of the Flood Insurance Program.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
PEMIGEWASSET RIVER							
REACH 1	0001,0002 0005,0006	–8.2	–2.5	5.9	080	A16	VARIES–SEE MAP
BEEDE BROOK							
REACH 1	0007	–2.7	–0.5	0.8	025	A5	VARIES–SEE MAP
REACH 2	0007	–1.0	–0.3	0.7	010	A2	VARIES–SEE MAP
OWL BROOK							
REACH 1	0007	–1.5	–0.4	0.8	015	A3	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

FLOOD INSURANCE ZONE DATA

PEMIGEWASSET RIVER - BEEDE BROOK - OWL BROOK

A Flood Hazard Boundary Map has been published by the Federal Insurance Administratrion (Reference 8). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, The J.W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

8.0 REFERENCES AND BIBLIOGRAPHY

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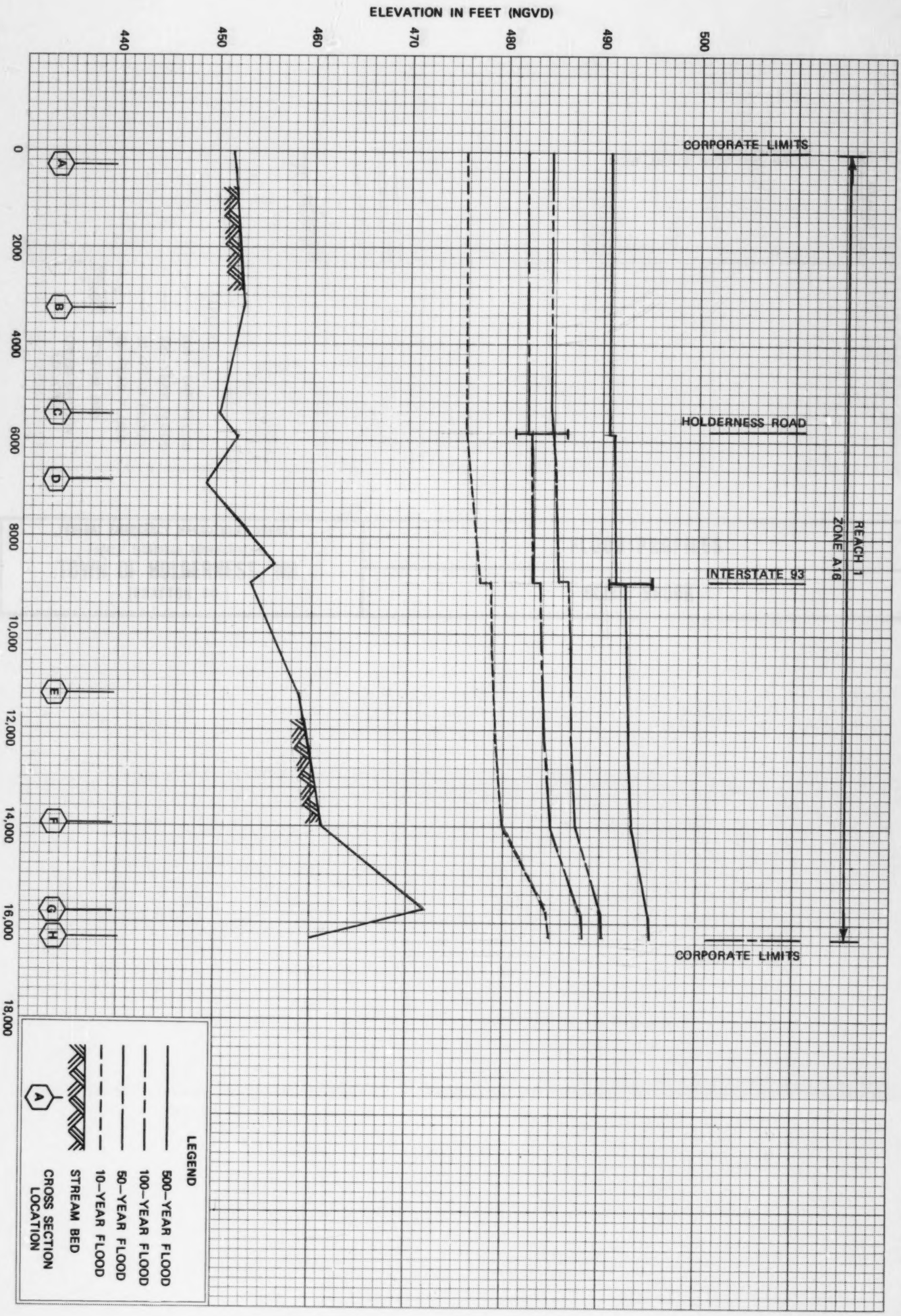


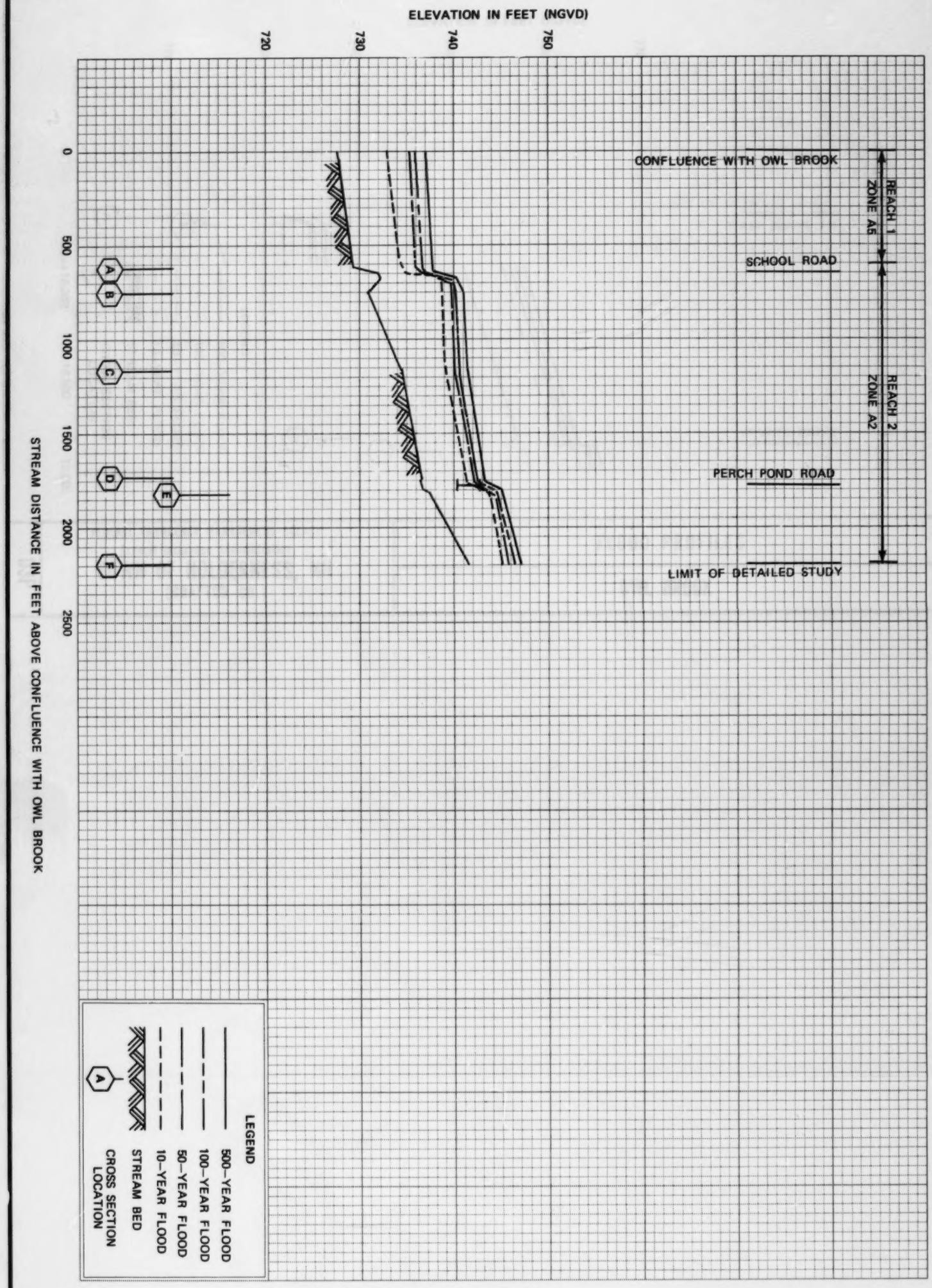
01P

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

FLOOD PROFILES

PEMIGEWASSET RIVER



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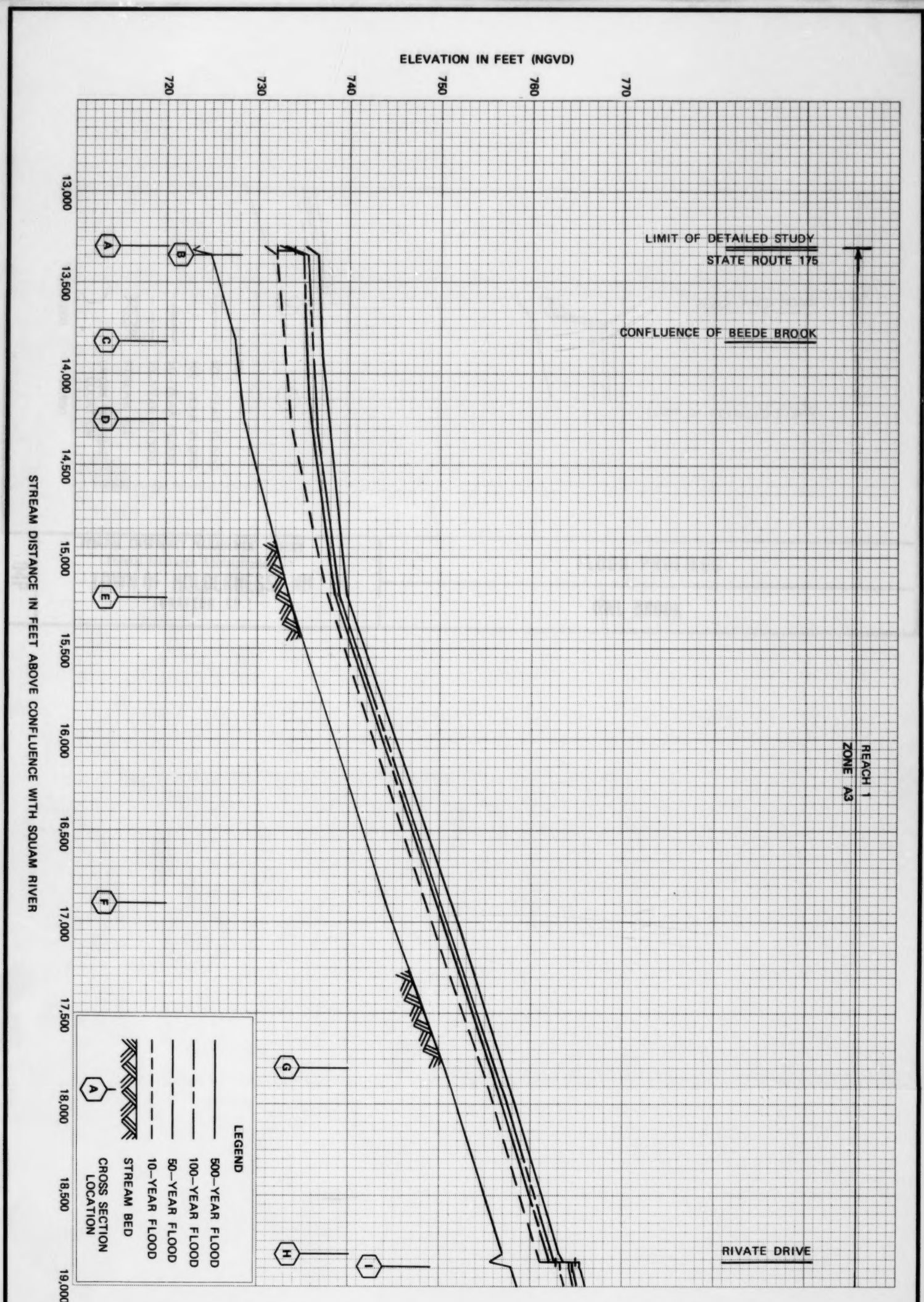
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

FLOOD PROFILES

BEEDE BROOK



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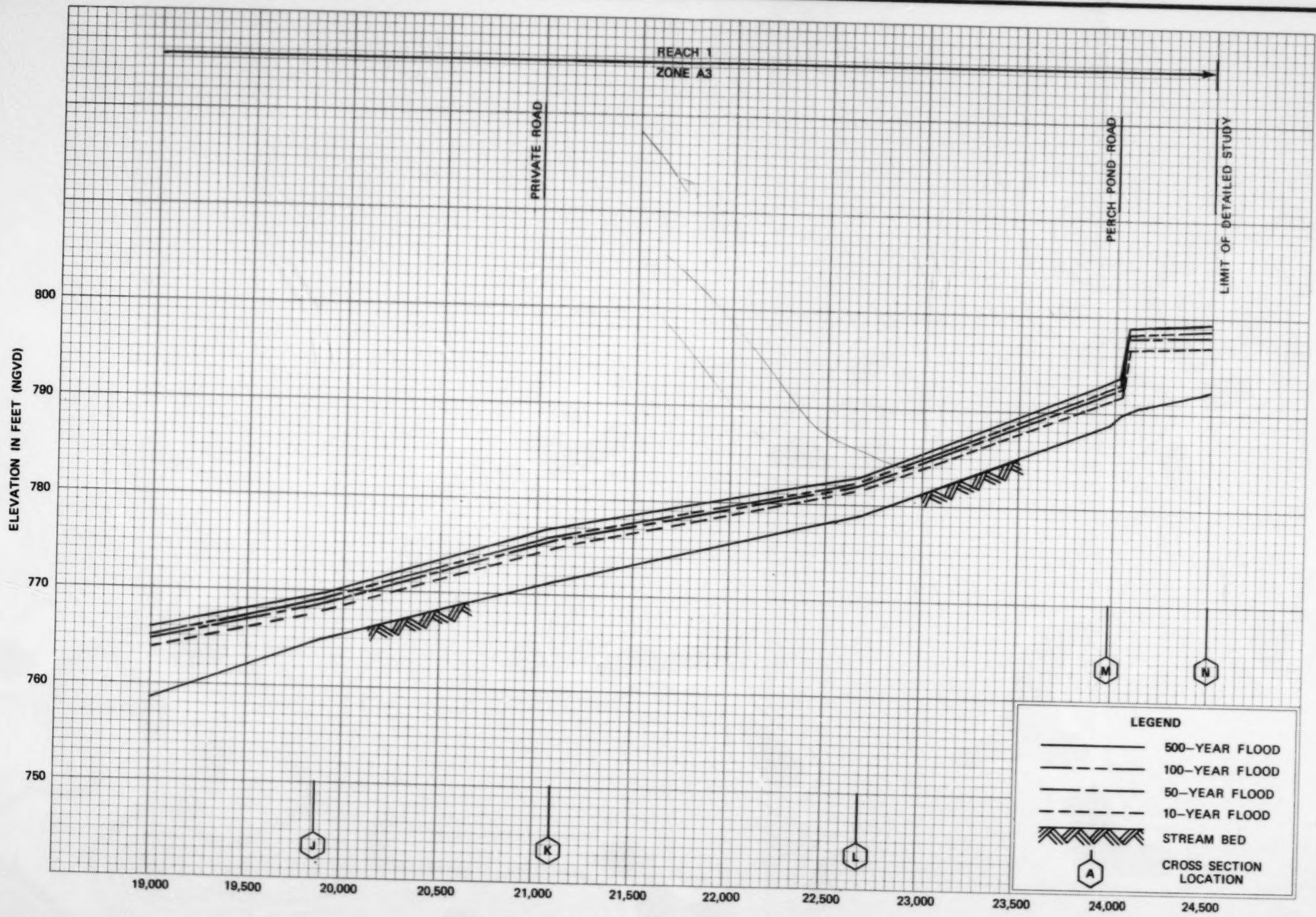
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

FLOOD PROFILES

OWL BROOK



FLOOD PROFILES

OWL BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HOLDERNESS, NH
(GRAFTON CO.)

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